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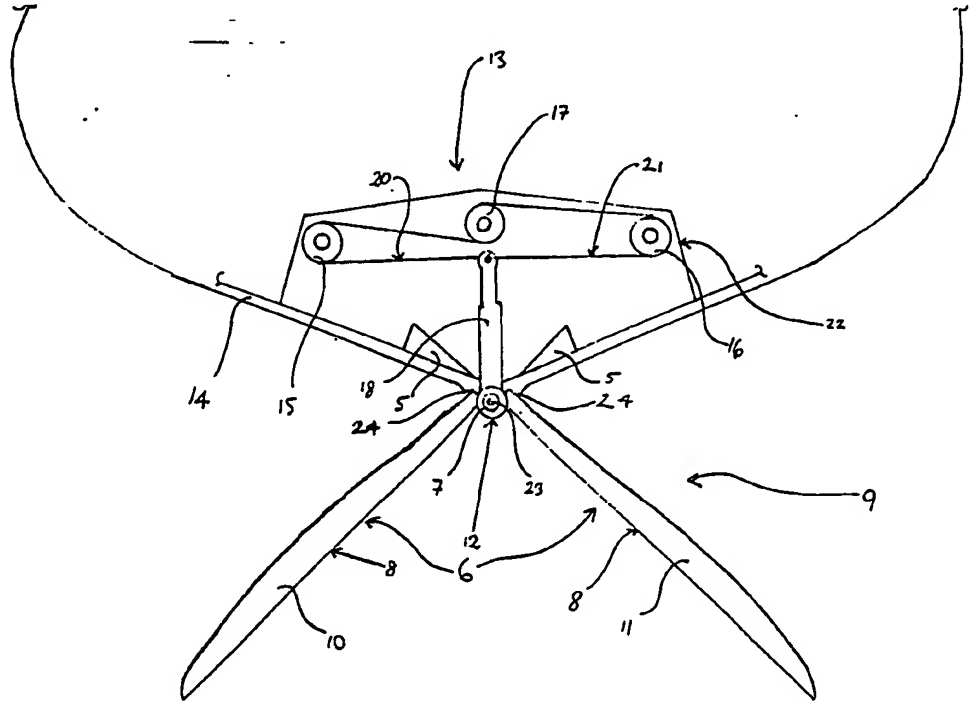

(57) Abstract

A keel structure (9) adapted for use on sailing craft, comprising a pair of like dimensioned keel members (10, 11) each of which is connected at an upper end to a hinge means (12), the keel members (10, 11) each having an inner surface (8) which in a first position co-operate to form a keel (6) and means (13) to permit the keel members (10, 11) to be hingedly moved in a manner such that when moved out of the first position, the effective length of the keel (6) is reduced.

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SPLITWING KEEL

The present invention relates to keels for use on boats and more particularly to keels adapted for use on sailing craft which are capable of having their effective length reduced.

As used in this specification, "keel" refers to a keel external to and projecting below the hull of a sailing craft, the weight of which is provided to hold the sails of the craft against the wind, maintain the craft in balance and to permit the craft to be sailed into the wind. The term "effective length" refers to the amount a keel projects below a hull being the dimension defined between a notional line drawn parallel to the transverse axis of the craft and passing through the point of attachment of the keel to the hull and a notional line also drawn parallel to the transverse axis but contacting the lower end of the keel.

Keels have been used on sailing craft in a variety of configurations, dimensions and weights in order to achieve desirable sailing performance.

Typically the dimensions and weight of a keel will be determined by such factors as the sail area, the degree of craft stability required, the dimensions of the hull, weight of the craft and the like. In addition, depending on how the sailing craft is to be used, the configuration and number of keels may be important. Thus, for example, in the case of a sailing craft for use in racing, the keel will desirably have a hydrodynamically efficient shape in order to reduce any drag as the craft moves through the water.

In many cases in order to provide a sailing craft with a keel which is satisfactory for its intended purpose, the effective length of the keel is frequently relative to the whole length, quite long. The presence of keels therefore generally gives rise to a number of

difficulties in use. These difficulties include the need for water of adequate depth to ensure that the keel does not foul the bottom and when a craft is removed from the water for maintenance, the need to provide a mounting cradle of adequate dimensions to stably support the craft whilst ensuring the keel does not contact the ground.

These difficulties have been well recognised in the past and as a result there are known in the prior art keels which are capable of having their effective length reduced to permit sailing craft to be sailed or moored in shallow water and to be readily beached to remove from water without the need for elaborate mounting cradle.

One example of such prior art is the center board, which is in effect a keel which is capable of being completely withdrawn of the sailing craft to give essentially a nil effective length. Typical examples of embodiments of the center board are to be found in small sailing craft such as skiffs and dinghy. In these craft, typically the centre board is raised or lowered by hand either directly or using a mechanically efficient pulley system. It is to be noted, however, that the weight of the center board in such craft is generally low for the reason that craft balance is controlled by the positioning of the crew. Thus, while a center board provides some stability, its main function is to allow the craft to be sailed into the wind.

In larger craft, typically those having a length of more than about 4.5 metres, the keel may be of the "swing" keel type comprising a metal plate which is pivotably connected to the craft at an upper end and is hauled into the craft by raising the lower end. The total weight of such keels is determined by their overall dimensions. In this case, in order to allow the keel to be withdrawn completely into the craft, it needs to be essentially a parallel sided plate. Since no additional weight of the

type used in the case of conventional fixed keels, may be added to these keels, limitations on craft design are imposed. Notwithstanding these limitations, many craft have been designed of the so called "trailer sailer" type. Typically, these are sailing craft capable of carrying a number of passengers and crew in relative comfort and safety, which have a swing keel capable of being retracted completely in the craft to give a hull that may be readily mounted on a trailer or used under power with the draft essentially that of the hull.

It must also be mentioned that the swing keels of the aforementioned type are generally capable of being adjusted into positions intermediate those in which it is fully retracted and those in which it has maximum effective length. The advantage of this adjustment facility being that in some sailing situations, an intermediate keel effective length provides improved sailing performance.

In another example of keels that are capable of having their effective length reduced, a keel of the aforementioned swing keel type is provided with an appropriate amount of weight in the form of ballast at its or adjacent its lower end. In these cases, the keel when raised to its maximum effective length always projects below the hull by an amount equal to at least the dimension of the ballast.

It is a characteristic of all of the aforementioned keels, that as a result of full or partial retraction into a craft, considerable space is taken up by the retracted keel and its associated casing within the craft.

In a still further example, a keel has been provided that is capable of being moved about its transverse axis in a direction either towards the port or starboard sides of the hull. Movement of this keel in either direction away from its normal position will result in the reduction

in the effective length of this keel.

The present inventors understanding is that this keel has been designed to increase craft performance under defiant sailing conditions rather than to have it as its object an effective means for reducing a keel's effective length.

The present inventor has recognised the limitations in these prior art keels and accordingly, the present invention has as its object the provision of an alternative to the prior art keels that is capable of being reduced in effective length whilst avoiding substantially the prior art limitation of keel design constraints and space occupied by a keel when retracted.

The present invention consists in a keel structure adapted for use on a sailing craft, comprising a pair of like dimensioned keel members, each of which is connected at an upper end to a hinge means, said keel members each having an inner surface which in a first position are in co-operation to form a keel, and means to permit said keel members to be hingedly moved in a manner such that when moved out of the first position, the effective length of said keel is reduced.

It will be evident that a keel of the invention is capable of having its effective length reduced by causing each of the keel members to pivot in an arc whereby the lower end of the keel members moves toward the hull. Since the movement is arcuate, it follows that any position that the keel members occupy, other than the first position, will result in a reduction of effective keel length.

One of the advantages of the invention is that it is capable of being applied to any size or weight of keel and therefore no limitation is placed on selecting the other dimensions of a sailing craft.

Another advantage is that as a result of the keel

being external to the hull in its retracted and fully extended position, relatively less space is taken up within the craft by the keel.

It is preferred that the means provided for moving the keel members apart functions in a manner such that the keel members are equally spaced apart at all times from the first position. The effect of this positioning of the keel members is that their weight will be equally distributed on either side of the mid point of the hull, thereby ensuring that the sailing performance will be substantially equal on any point of sailing.

The length of the keel members will be selected in accordance with the overall design of a craft and will depend on a number of factors. Preferably, the length of the keel members will be selected to ensure that when the keel members are maximally spaced apart, the lower ends will not extend outside the broadest part of the hull.

The extent to which the hull members may be moved apart will be limited by the type of hinge means used to connect the keel members. In a preferred embodiment, a hinge means which allows the keel members to be spaced apart to the maximum extent is used. In this latter position, the inner surfaces of the keel members will be coplanar and parallel to the transverse axis of the craft. A hinge means capable of performing in this way comprises a pin mounted at each of its ends, to which are pivotably connected an upper end of each keel member. The connection is preferably by way of a bearing for each of the keel members.

It is preferred that when the keel members are in the first position to form a keel, the inner surfaces cooperate in manner such there is substantially no gap between them. This ensures that in use water will flow around the outer surfaces in a smooth non-turbulent fashion thereby not impeding the performance of a sailing

craft.

Similarly, the outer surfaces of the keel members will be preferably shaped so that when in the first position, the keel will have an efficient hydrodynamic shape.

A keel of the invention may be formed from any suitable material which has sufficient density and strength. In practice, generally the material will be a metal or an alloy. A material preferred to form a keel is wrought iron.

The means provided to hingedly move the keel members is preferably capable of stably holding the keel members maximally spaced apart or in the first position. Desirably, these means provide for continuous adjustment of the position of the keel members from the first position to the maximally spaced apart position.

The means for hingedly moving the keel members preferably comprises a pair of arms, each of which is connected to a corresponding upper end of a keel member at the hinge means, said arms being maximally spaced apart when said keel members are in the first position, and means capable of acting on said arms to move them in a manner such that the keel members may be maximally spaced apart.

The means capacble of moving the arms may be, for example, a pair of steel wires, each of which is connected to a corresponding upper end of an arm and to a drum, which when rotated causes the wires to be wound on in opposite directions thereby causing the arms to be pulled together and the keel members to be moved apart. In this case, the drum could be rotated using a winch of appropriate mechanical advantage. Pulleys and the like can also be provided to increase mechanical efficiency.

Naturally, in situations where the keel is of relatively greater weight, the means for hingedly moving

the keel members may be mechanically driven. An example of such means may be as previously described except an electric motor rotates a drum. Alternatively, an hydraulically driven means may be used to move the arms.

In place of single arms, a plurality of linked arm members may be used in order to achieve appropriate mechanical advantage and to fit into the craft in the minimal amount of space.

It is preferred that the means for hingedly moving the keel members is located within a sailing craft in proximity to the upper ends of the keel members. In this situation, the upper ends of the keel members will be dimensioned and positioned to provide a small gap between the hull and that part of the keel member that enters the hull. Clearly, this gap will potentially provide a point of water entry into the craft. However, in a preferred embodiment, the means for hingedly moving the hull members and the upper end of the hull members together with the hinge means are contained within a sealed space in the craft. Such an arrangement will allow only the entry of a small amount of water into this space.

In a particularly preferred embodiment, a gas such as compressed air is bled into the sealed space in an amount and pressure sufficient to exclude water from the space.

Given the foregoing possibility of water entry, it is preferred the means for hingedly moving the hull members are formed from materials that will not be corroded by either fresh or salt water. A preferred material is stainless steel.

It will be seen from the foregoing description that one advantage of this invention is that it allows the sailing craft to be beached or to be placed on a dockside when the keel members are spaced maximally apart; the keel members providing a flat, level mounting surface for the craft.

Further, although the center of gravity of a sailing craft is moved upwardly as the effective length of the keel is reduced, the present inventor believes that the center of gravity for keels of the invention will be relatively lower for a given effective keel length than prior art comparable keels. The effect of this is that a sailing craft having a keel of the present invention would be more stable.

A still further advantage is that the present inventor believes that when the keel members are appropriately spaced apart, they will render a craft when not under sail more stable against choppy seas by reducing the amount of pitch and roll.

Hereinafter by way of example only is a preferred embodiment of the present invention described with reference to the accompanying drawings in which:-

Fig. 1 is a cross-sectional view of a keel structure of the present invention;

Fig. 2 is a cross-sectional view of a keel structure of the present invention;

Fig. 3 is a cross-sectional view of a keel structure of the present invention;

Fig. 4 is an exploded sectional view of an arm, of the embodiment of Figures 1 to 3.

Fig. 5 is a cross-sectional view of another embodiment of a keel of the present invention.

The keel structure 9 described with reference to Figs. 1, 2 and 3 comprises a pair of keel members 10, 11, having inner co-operating surfaces 8, a hinge means 12 and means 13 for hingedly moving the keel members. The hull in which the keel structure is mounted is shown by reference numeral 14.

The means 13 comprises pulleys 15, 16, a winding drum 17, a pair of arms 18, 19, each of which is connected respectively through the hinge means 12, to a keel member

10, 11 and two pairs of steel wire ropes 20, 21. Each of the arms 18, 19 are held against stops 5 when keel members 10, 11 are in the first position. Wire rope 21 is connected to the upper end of arm 18, is passed over pulley 16 and connects to the top of the winding drum 17. Similarly, wire ropes 20 are connected to the upper end of arm 19, is passed over pulley 15 and connects to the bottom of winding drum 17.

A case 22 surrounds the means 13 to provide an effective gas and water seal.

The hinge means 12 comprises a pin 23 mounted on bearings 7. The arms 18, 19 and their correspondingly connected keel members each pivot around the pin 23.

A small gap 24 between the hull 14 and the keel members 10, 11 is provided in order to allow the keel members to be moved into spaced apart arms as shown in Figs. 2 and 3.

Both of the arms 18, 19, as is shown in Fig. 4 comprise a pair of rods 25 which are connected at their upper ends to a wire rope 20 or 21. At their lower ends, each of the rods are slidingly fitted into cylinders 26, which in turn are adapted to pivot with the pin 23. In use, the keel 9 is reduced in effective length by moving the keel members 10, 11 apart from the first position shown in Fig. 1 to the position shown, for example, in Figs. 2 and 3.

In order to move the keel members 10, 11, the winding drum 17 is caused to rotate in a clockwise direction. As the drum 17 is wound, the wires 20, 21 are wound onto the drum and the arms 18, 19 are pulled towards each other. As each of the arms 18, 19 are moved, the rods 25 slide into the cylinder 26, thereby maintaining the arms at a constant length.

As shown in Fig. 1 the keel members co-operate to form a keel 6.

In Fig. 2, where the arms 18, 19 have been moved through 45°, the keel members 10, 11 are spaced 90° apart and it will be seen that the effective length of the keel has been appropriately reduced. With further winding of the drum 17, the arms 18, 19 will be moved to a side of the hull opposite to that of the first position and the keel members 10, 11 will be maximally spaced apart as shown in Fig. 3. In this position, the arms 18, 19 will be held against stops 5.

This particular embodiment is largely suited to smaller craft as the effort required to rotate the winding drum is directly proportional to the weight of the keel members.

The keel members 10, 11 are formed of wrought iron and in the configuration shown in Fig. 3, the overall draught has been reduced by 65%.

The embodiment shown in Fig. 5 is similar to that shown in Figs. 1 to 3 and like referenced numerals have the same meaning as in these figures.

This particular embodiment is suited to larger craft, which, owing to the greater weight of the keel members 10, 11, requires a more robust and mechically efficient means for hingedly moving the keel members.

In this embodiment, the means 30 for hingedly moving the keel members 10, 11 comprises a pair of arms 31, each of which connects at a lower end to hinge means and keel members as previously described. At an upper end, a sprocket 32 is provided, which sprocket is in engagement with a toothed surface 33. An hydraulically driven motor 34 mounted on the upper end of each arm 31 drives sprocket 32.

In use, when the hydraulic motors 34 are activated, the arms 31 move in a direction towards each other as the motors drive the sprockets 32 on the toothed surface 33.

When the keel members 10, 11 are fully spaced apart,

the arms 31 will be on a side of the hull opposite to the side when the keel members were in the first position.

CLAIMS:

1. A keel structure adapted for use on a sailing craft, comprising a pair of like dimensioned keel members, each of which is connected at an upper end to a hinge means, said keel members each having an inner surface which in a first position are in cooperation to form a keel, and means to permit said keel members to be hingedly moved in a manner such that when moved out of the first position, the effective length of said keel is reduced.

2. A keel structure as claimed in claim 1, wherein the keel members when moved out of the first position are spaced equally apart from said first position.

3. A keel structure as claimed in claim 1 wherein the length of each keel member is such as to not extend outside the broadest apart of the hull.

4. A keel structure as claimed in claim 1 wherein the inner surface of the keel members when maximally spaced apart are coplanar and parallel to the transverse axis of the craft.

5. A keel structure as claimed in claim 1, wherein the hinge means comprise a pin mounted at each of its ends, each keel member being connected to said pin by a bearing structure.

6. A keel structure as claimed in claim 1, wherein the inner surfaces have substantially no gap between them.

7. A keel structure as claimed in claim 1, wherein the means for hingedly moving said keel members are capable of maintaining the keel members stably in any position between the first and that where the keel members are maximally spaced apart.

8. A keel structure as claimed in claim 7, wherein the means comprise a pair of arms, each of which is connected to a corresponding upper end of a keel member at the hinge means, said arms being maximally spaced apart when said keel members are in the first position and means capable

of acting on said arms to move them in a manner such that the keel members are maximally spaced apart.

9. A keel structure as claimed in claim 8, wherein said means comprises a pair of wires, each of which is connected at one end to a corresponding upper end of said arm, and at the other end to a drum capable of being rotated to wind on said wires.

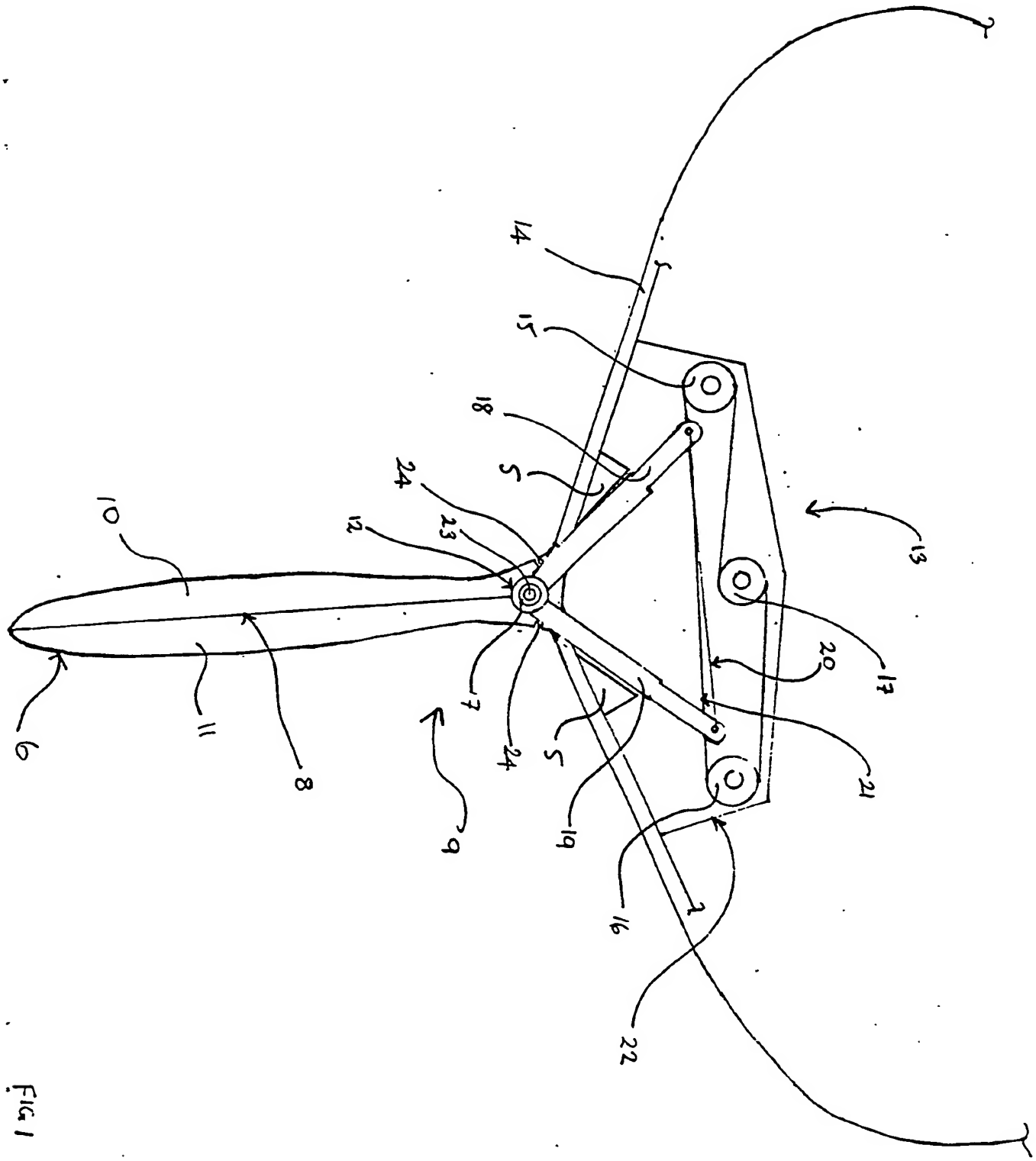

FIG 1

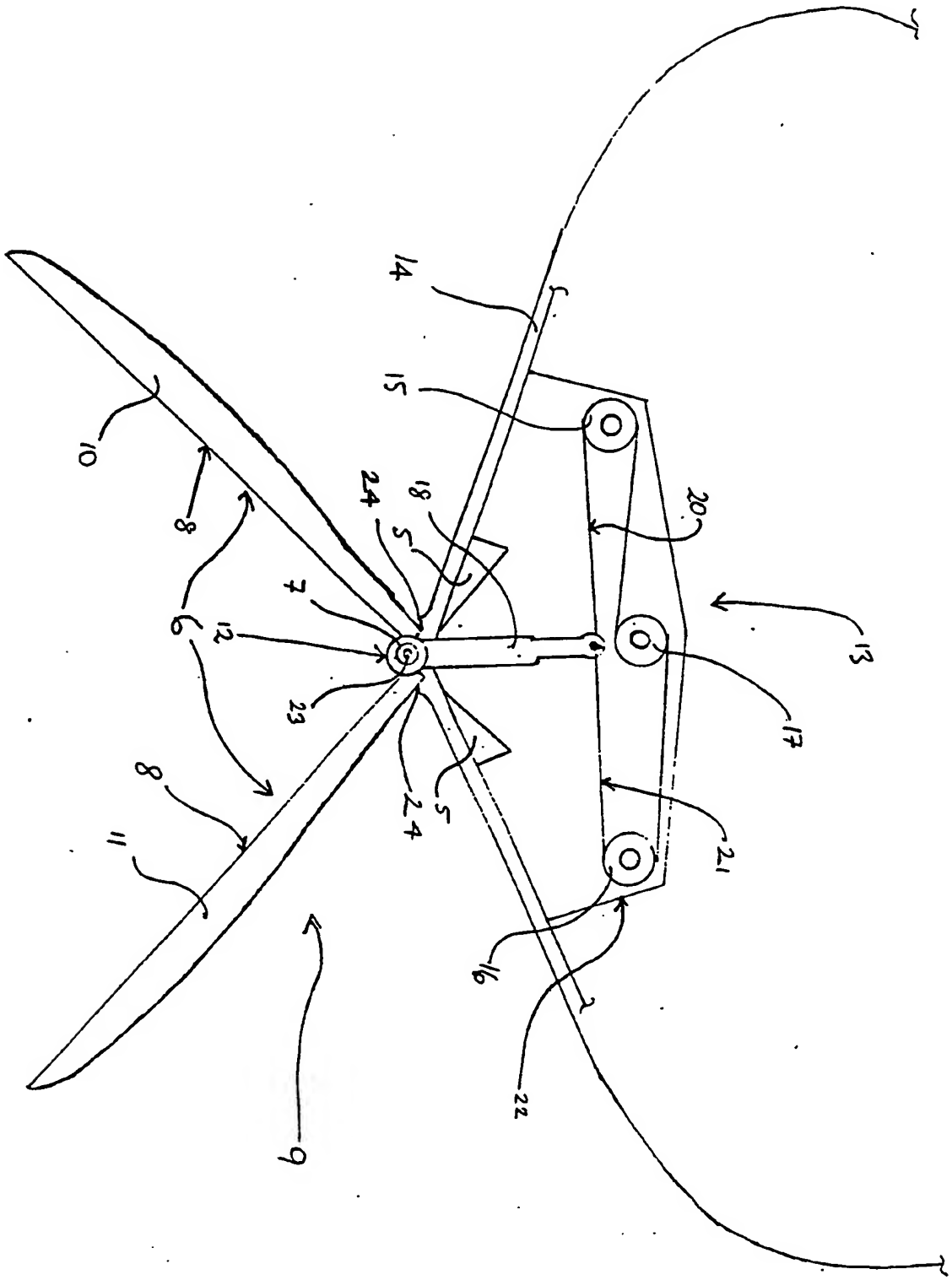

FIG 2

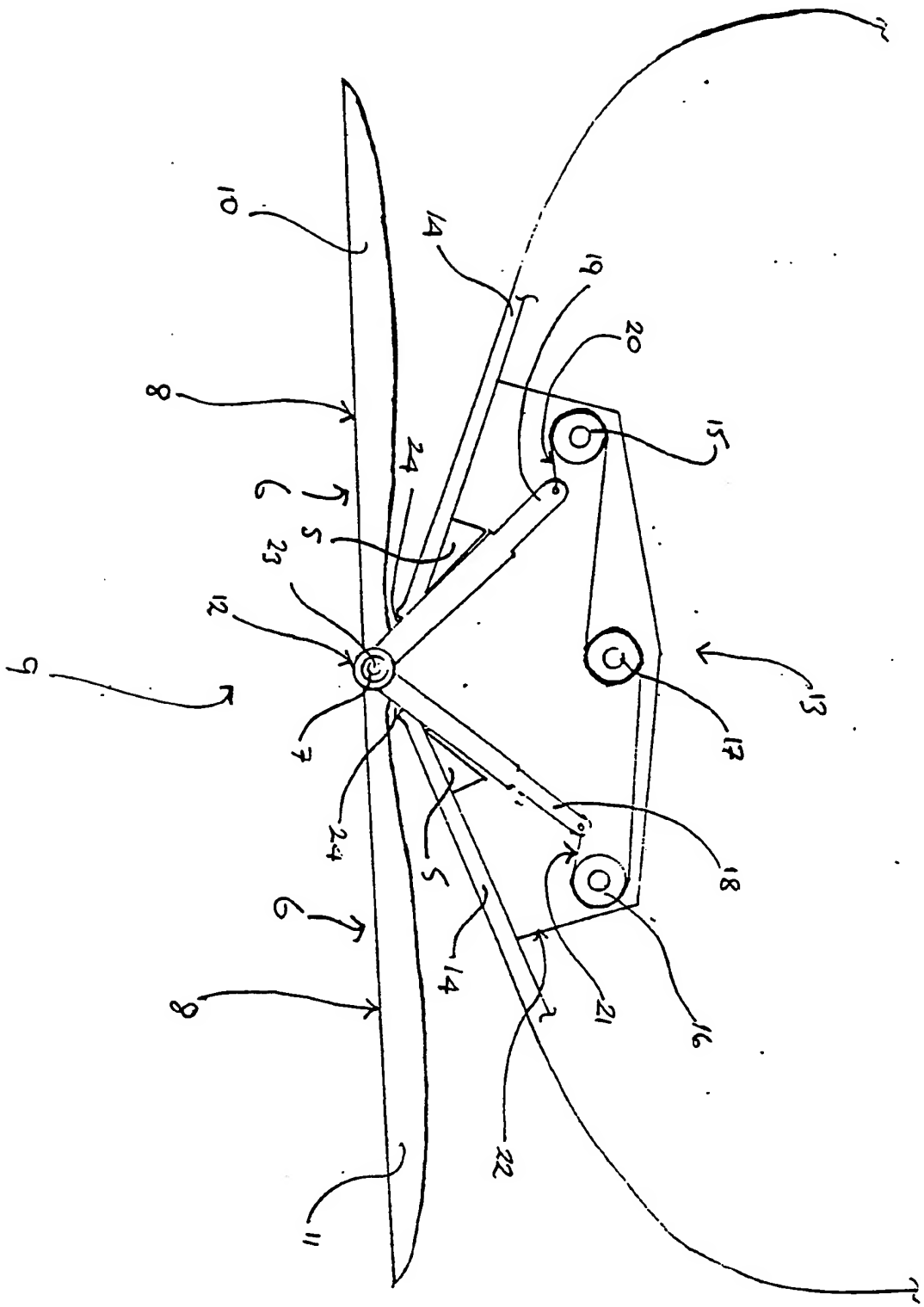

FIG 3

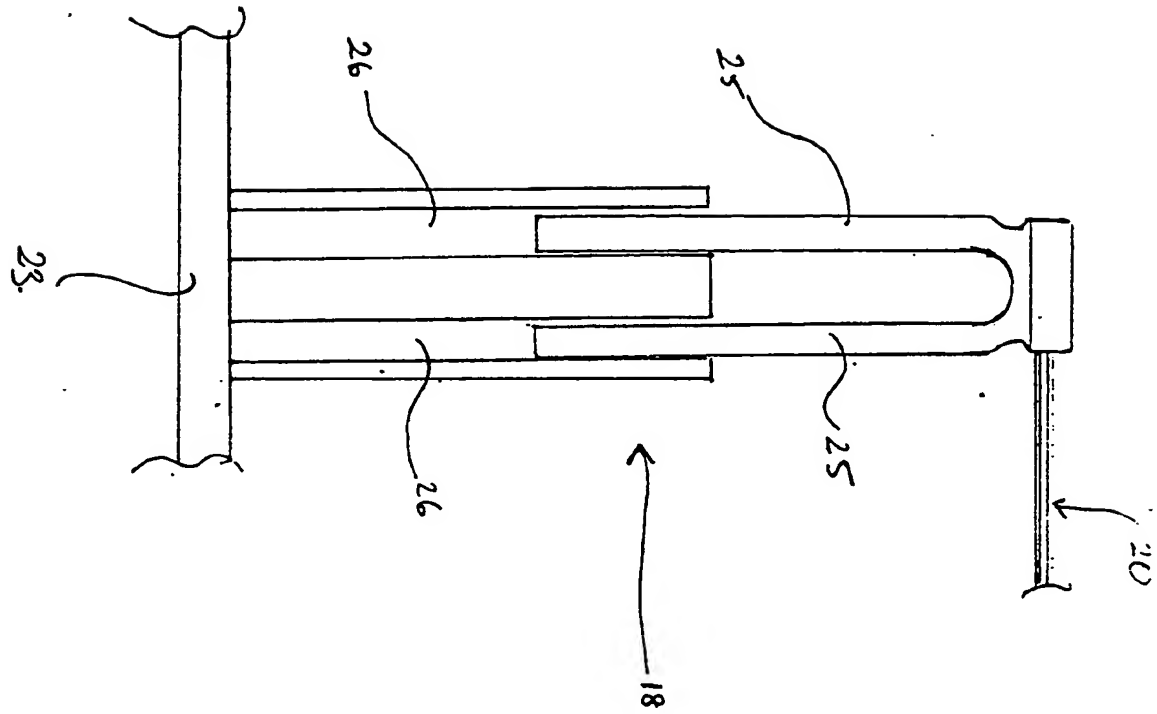

FIG 4

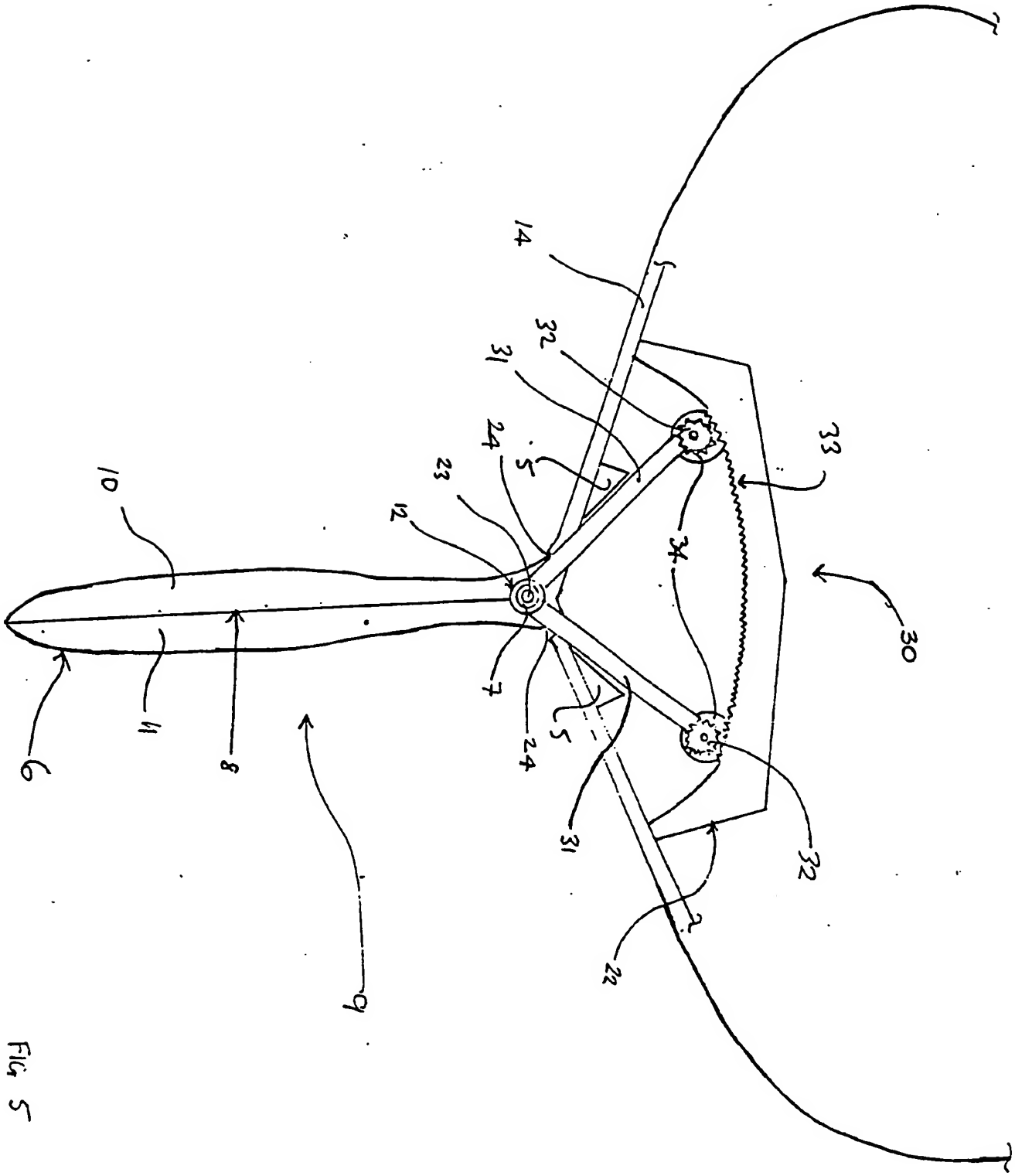

Fig 5

INTERNATIONAL SEARCH REPORT

International Application No PCT/AU 86/00190

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.[4] B63B 3/38

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	B63B 3/38, 41/00

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

AU : IPC as above; Australian Classification 91.2

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	AU,B, 14027/62 (266680) (EMCKEN) 30 January 1964 (30.01.64)	(1-9)
X	DE,A, 2551319 (SCHWARZ) 26 May 1977 (26.05.77)	(1-8)
X	DE,A, 2941424 (ZUHIKE) 23 April 1981 (23.04.81)	(1,2,4-8)
X	DE,A, 349778 (MULSOW) 7 March 1922 (07.03.22)	(1-9)
X	DE,A, 349779 (MULSOW) 7 March 1922 (07.03.22)	(1-9)
X	FR,A, 1430517 (BONCA) 24 January 1966 (24.01.66)	(1,2,4-8)
X	FR,A, 1585199 (De REVIERS et al) 9 January 1970 (09.01.70)	(1-8)
X	FR,A, 2501147 (MOINARD) 10 September 1982 (10.09.82)	(1-8)
X	US,A, 4378748 (KURTZ) 5 April 1983 (05.04.83)	(1-8)

* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
9 September 1986 (09.09.86)	17 SEP 1986
International Searching Authority	**Signature of Authorized Officer**
Australian Patent Office	P. WARD